14th ANNUAL

NONPOINT SOURCE WATER QUALITY MONITORING RESULTS WORKSHOP

ABSTRACTS

January 6, 7, and 8, 2004

Boise State University
Student Union Building
Boise, Idaho

Sponsored by:

Idaho Department of Environmental Quality
Idaho Department of Fish and Game
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Watershed Professional Network

ABSTRACTS

TUESDAY, January 6, 2004

1:00 – 2:00 pm **KEYNOTE SPEAKER**

Randy Smith, U. S. Environmental Protection Agency

Data, Data Everywhere and Not a Drop to Drink

3:20 – 3:40 pm

Melissa Thompson
Idaho Department of Environmental Quality
900 North Skyline, Suite B
Idaho Falls, Idaho 83402
Phone: (208) 528-2650
Email: mthompso@deq.state.id.us

Development and Practical Use of Geomorphic Risk Assessment in the Willow Creek Subbasin Assessment and Total Maximum Daily Load

A geomorphic risk assessment (GRA) provides a tool for identifying high, medium, and low geomorphic risk areas in a watershed based on sediment transport capabilities and potential sediment sources. This analysis is useful as a preliminary screening tool for identifying areas in a watershed with acute sedimentation issues.

In preparation for the subbasin assessment and TMDL, a GRA was completed for the Willow Creek subbasin. Benefits and limitations with the use of GRA in subbasin assessments and TMDLs will be discussed.

3:40 – 4:00 pm

David F. Ferguson
Idaho Soil Conservation Commission
P. O. Box 790
Boise, Idaho 83701
Phone: (208) 332-8654
Email: dferguso@agri.state.id.us

Riparian Assessment Strategy for the Upper Owyhee and Snake River Temperature TMDLs

The Idaho Department of Environmental Quality has determined that various tributaries within the Upper Owyhee and Mid Snake-Succor TMDL areas in Southwest Idaho are exceeding stream water temperature for the aquatic cold water beneficial uses. Within the TMDL process, a stream channel shade "surrogate" load allocation has been set to meet water quality standards for these cold water uses. The TMDL stream shading targets range from above 50% to 100% on streams with a wide range of variability.

Livestock grazing is likely the most widespread use within these two TMDL areas, and has basically been targeted to increase stream shading. There are numerous riparian inventory and assessment techniques, widely used across North America, but few built with the intention of determining the appropriate land use management to meet a shading target. In 2003, numerous assessment techniques were used to identify the actual stream riparian and channel conditions on privately owned, deeded land. The natural physical variability of the stream characteristics and the current land management effects on the riparian and channel conditions have been recorded. It is most likely that reductions in channel width, an increase in bank angle, and a reasonable increase in shading will create more suitable habitat for the beneficial uses (fisheries). However, It is not certain if these physical changes will actually meet the existing state water quality standards for stream water temperature. Land management adjustments are currently being discussed with each of the landowners, reflecting on actual riparian inventory data, the landowner's history of use, and the capability of each stream segment in supporting actual beneficial uses.

4:00 – 4:20 pm

Matthew Boyd
Carollo Engineers
4380 SW Macadam Avenue, Suite 350
Portland Oregon 97239
Phone: (503) 227-1885
Email: mboyd@carollo.com

TMDLs for the Umatilla Tribe

The Umatilla River, Oregon, suffers from prolonged periods of sub-optimal and incipient-lethal river temperatures. Salmonids are highly adaptable and can utilize a wide variety of habitat; however, they require cool water temperatures. When exposed to temperatures greater than 18°C (64°F) rearing and migrating salmonids modify their behavior to alleviate stressful increases in their metabolic rates. In the Umatilla River salmonids seek out and move into cool water sources, such as tributaries, spring brooks or headwaters, but can become trapped by thermal barriers and low flows. This analysis considers land uses that contribute to stream heating: floodplain dissection, vegetation removal/disturbance, channel modifications (from bridges and roads railroads) and hydrologic disturbance (such as groundwater withdrawals). The influence of groundwater upon stream temperature dynamics is an important component to the habitat integrity of the Umatilla River. Hyporheic exchange between the river and the alluvial aquifer offers important heat moderation during periods of sub-optimal river temperatures (June through September). This effort broadens the range of 'traditional' thermal sources to include the connection of the river to the alluvial aquifer via interrelated processes and landscape features in the floodplain, namely: land cover, morphology and hydrology (including subsurface water withdrawals). Remote sensing from aircraft is used to image topographic and land cover surfaces, and to detect the spectral patterns (electromagnetic signatures emitted from trees, ground surfaces, water, etc.) over the stream and floodplain. These data sets are extensively utilized in the analysis (for statistical analysis and as model inputs). Thermal infrared radiometry (TIR) was collected using a helicopter with a sensor (radiometer) that measures thermal radiation emitted from the ground, vegetation and the stream. Light intensity detection and ranging (LIDAR) was measured from an airplane with an instrument that emits laser pulses toward the ground that are then reflected back to a sensor, providing high resolution topography and land cover height data. Aerial photos provided visual information that can be used for mapping land cover and morphology features. Historical air photos (1949) were used to map stream position and land cover distributions. These spatial data sets are complied over a basin-scale and used as inputs for computer models to simulate hydrology (river flow, hyporheic exchange) and thermodynamics (heat transfer). Three computer models were used: HEC-RAS (stream hydraulics), Wetlands Dynamic Water Budget Model (vertical hyporheic exchange) and Heat Source (heat transfer, mixing with tributaries, longitudinal hyporheic flows and stream temperature). Statistical analysis tested the developed theoretical basis for longitudinal and vertical hyporheic exchange. Simulated results indicate that hyporheic exchange is an important process for heat moderation and localized cooling in the Umatilla River. Morphology is a primary control of hyporheic exchange.
Prepared for the Confederated Tribes of the Umatilla Indian Reservation

4:20 – 4:40 pm

Mark Shumar
Idaho Department of Environmental Quality
1410 N. Hilton
Boise, Idaho 83706
Phone: (208) 373-0132
Email: mshumar@deq.state.id.us

Feasibility of Canopy Coverage Estimation for Temperature TMDL Targets in Non-Forested Streams

Canopy cover of vegetal communities has been used in plant ecology studies for many years as a method of measuring a plant species relative importance in a community. Canopy cover or canopy density is a vertical project of a plant's canopy onto the ground surface, and functions as a surrogate to measuring the plant's biomass. Effective shade, on the other hand, is a three-dimensional interaction of objects, such as vegetation, and the sun. In riparian plant communities, canopy coverage, or more importantly, effective shade on the stream has been recognized as an important factor in keeping streams cool to prevent adverse effects to cold water aquatic life. Using cover or shade estimation techniques therefore makes sense for quantifying the conditions of riparian plant communities and their ability to keep streams cool.

This study was designed to see if aerial photo interpretation techniques could be used to estimate canopy cover on non-forested streams. Similar techniques have been performed for forested streams in northern Idaho. It is unknown whether or not aerial photo interpretation of canopy cover can be done for rangeland streams in southern Idaho.

This study compared aerial photo interpretation to field verification of canopy coverage. Additionally, a solar pathfinder was used in the field verification activities to see the relationship between canopy coverage and effective shade. Results showed that canopy cover estimates from digital ortho-photo quads in two-dimensional vision were similar to field verification results, however, they were extremely difficult to interpret and interpretations varied with observer. Stereo (3-D) views of Forest Service flight line aerial photos were easier to visualize; however, their results were not unlike those obtained from two-dimensional digital photos. Field verification of shade using a solar pathfinder provided interesting results and a method to convert shade directly to solar loading in $kWh/m^2/day$. Solar loading is an important aspect of total maximum daily loads for temperature.

WEDNESDAY, January 7, 2004

8:00 – 8:20 am

Steve Miller and Sherrill Doran
CH2M Hill
700 Clearwater Lane
Boise, Idaho 83712-7708
(208) 345-5310

Link to Presentation: *Linked Model to Estimate Stream Bank and Watershed Sediment Loading*

The purpose of a Watershed Management Plan is to develop a realistic, implementable framework for watershed protection, which includes combining watershed controls like best management practices and land use management. Watershed studies are conducted, however, at such a large scale that the effects of individual source control measures cannot be evaluated. Without this information, it is difficult to strike a balance between watershed protection, economic growth, and quality of life issues.

What is Low Impact Feasibility Evaluation (LIFE™)?

LIFE™ is a modeling tool that optimizes the balance between economic growth and watershed protection. LIFE™ finds the least-cost stormwater management solutions that meet watershed protection and quality-of-life objectives. LIFE™ can be used to:

- identify appropriate, site-specific best management practices, and
- evaluate the effects of volume-based, peak flow, and water quality controls.

The model calculates stormwater runoff and pollutant loadings from buildings, roadways, and landscaping under various land uses and soil types, for both new development and redevelopment.

Who Needs LIFE™?

- Cities and counties can use LIFE™ for stormwater master planning, stormwater utility implementation, stormwater NPDES Phase II permitting, redevelopment planning, development plan review, and credit trading initiatives. LIFE™ can perform analyses using existing GIS coverages.
- Developers can use LIFE™ to optimize site design for the greatest return on investment, generate applications for stormwater permits, and support credit trading.
- Military facilities can use LIFE™ to optimize site redevelopment and generate stormwater permit applications.
- Ports, harbors, airports, and transportation departments can use LIFE™ for stormwater management and permitting.
- Regulatory agencies can use LIFE™ to evaluate permitted compliance with NPDES and TMDL requirements.

What are the benefits of LIFE™?

LIFE™ finds the least-cost stormwater management solutions that meet watershed protection and quality-of-life objectives. LIFE™ can:

- define optimal solutions that satisfy multiple objectives
- save money by taking advantage of existing GIS coverages
- visually demonstrate the evaluation of stormwater management alternatives
- assess compliance with designated uses under the Clean Water Act

8:20 – 8:40 am

Stephen Bauer and Ed Saline
Watershed Professionals Network, LLC
Boise, Idaho

Link to Presentation: *Stream Channel Assessment and Restoration Recommendations in an Agricultural Watershed in Umatilla County, Oregon*

The Confederated Tribes of the Umatilla Indian Reservation contracted with Watershed Professionals Network (WPN) to conduct a hydrologic assessment and develop recommendations for restoration of the Tutuilla/Patawa Creek Watershed. The purpose of the project was to increase understanding of current stream channel, floodplain, water quality, and aquatic habitat conditions within the watershed to assist the tribe in developing project specific watershed restoration plans. The Tribe is interested in restoring the watershed because it is largely contained within the reservation boundary, supports anadromous and resident fisheries, and has been identified as a contributing tributary in the Umatilla River TMDL.

The study area includes the 158 km ^{2} (61.1 mi^2) Tutuilla/Patawa Creek Watershed, located in Umatilla County, near Pendleton, Oregon. Field surveys were completed on twenty 2 nd to 5th order stream sites, and ten 1 st order streams. Data collection included channel morphology, aquatic habitat, and streambank stability measures. Current, reference, and likely future conditions were organized by Rosgen stream types. Site potential channel geometry (W/D ratio, Bankfull width, Flood Prone Width, Sinuosity) was estimated using relationships based on the upstream drainage area and stream type. Restoration need was estimated by scaling up the sites within comparable reaches using GIS and aerial photo interpretation.

Restoration approaches were identified for each study site based on Oregon Department of Fish and Wildlife restoration guidelines, the Umatilla Basin Agricultural Water Quality Management Plan, the federal Stream Corridor Restoration guidelines, and the Umatilla Basin TMDL and Management Plan. The overriding disturbance factor in the basin is the degree of channelization within the cropland area; fifty-six percent of the 2nd to 5th order streams were channelized and classified as G or Ditched channels. Although highly altered, the watershed can be restored through a combination of riparian buffer restoration, stream channel reconfiguration, upland erosion control, and public education.

Jerry Middel, of Duck Creek Associates, led the field data collection.

8:40 – 9:00 am

Kimberly Ball
University of Idaho
P.O. Box 1202
Driggs, Idaho 83422

Estimating Streambank Erosion

The Idaho Falls Regional Office of the Department of Environmental Quality (DEQ) has been developing Total Maximum Daily Loads for sediment since 1996 to meet the requirements of the Clean Water Act. This research was conducted to estimate streambank erosion in the Big Lost River using a method developed by Dave Rosgen. The Rosgen procedure involves setting a local index for lateral erosion with erosion pins, a Bank Erosion Hazard Index (BEHI), and Near Bank Stress (NBS). Twenty seven sites with a wide range of BEHI and NBS ratings were selected on the East Fork of the Big Lost River. The East Fork is a low gradient, meandering, point bar system. BEHI and NBS were good predictors using Rosgen's (1996) method of estimating bank erosion. A multiple linear regression between BEHI, NBS, and measured lateral erosion was significant with a p-value of <0.001 and a r^2 value of 0.59.

9:10 – 9:30 am

Amanda T. Rugenski [1], G.W. Minshall [1], and R.J. Danhey [2]

[1]Dept. of Biological Sciences Idaho State University
Pocatello ID 83209
Phone: (208) 282-2139
Email: arugenski@yahoo.com

[2]Weyerhaeuser Corporation
Eugene, Oregon

Link to Presentation: *The Effect of a Riparian Fertilization with a 15N labeled Tracer on Stream Processes in Two Western Idaho Streams*

The purpose of this study is to measure the effects of a riparian fertilization on water quality and primary production in two western Idaho streams. An advantage of this approach is that these nutrients when taken up by riparian plants, would ultimately make their way into aquatic food webs more gradually and already bound into carbon-containing compounds. Pre-treatment results show that both Clear and Bogus Creeks are nitrogen limited. Aerial application of dry fertilizer pellets with a 15N tracer to light (224 kg/ha) and heavy (448 kg/ha) treatment section was completed in autumn 2001. During fertilization, NH4 levels in stream water were significantly higher than background levels and returned to pre-treatment levels after fertilization with no further increases above background. Periphyton response in nutrient-addition and control sections was measured through chlorophyll a, nutrient diffusing substrata, and stable isotope analyses. Pre-treatment chlorophyll a values in October 2001 showed no significant difference between treatments and control reaches ($p>0.005$). Post treatment results show a significant difference ($P< 0.001$) in chlorophyll a values between treatments and control reaches, with highest values in the heavy treatment. Chlorophyll a values for October 2002 show a significant difference from October 2001 ($P<0.001$). Aquatic macrophytes and filamentous algae showed an increase in d15N following fertilization. Future analyses will examine the incorporation of nitrogen into the trophic structure. We conclude that fertilizer application to the riparian zone of streams can have a significant effect on primary production within the stream without altering water quality. The results will have implications for stream restoration as well as for management. Understanding the relative influence of riparian vegetation on the functioning of stream ecosystems is fundamental for effective watershed management.

9:30 – 9:50 am

Dorene MacCoy and Terry Maret
U.S. Geological Survey
230 N. Collins Road
Boise, Idaho 83702
Phone: (208) 387-1354 – (208) 387-1328
Email: demaccoy@usgs.gov – trmaret@usgs.gov

Ecological Indicators of Water Quality in the Spokane River 1998–1999

A water-quality investigation of the Spokane River was completed during summer low-flow conditions in 1998-99, as part of the U.S. Geological Survey's (USGS) National Water-Quality Assessment (NAWQA) Program in cooperation with the Washington Department of Ecology (WDOE). Samples for analysis of water chemistry, bed sediments, biological communities (fish, macroinvertebrates, and algae), tissue contaminants (fish and macroinvertebrates) and associated measures of habitat were collected at six sites downstream from Coeur d'Alene Lake between river miles 63 and 100. These data provide baseline information to evaluate the water-quality status of the Spokane River and can be used to determine the ecological risk to aquatic organisms from contaminants.

Results of this investigation on the Spokane River indicate:

- Multiple stressors (contaminants and temperature) are impairing aquatic life.
- Major groups of native aquatic fauna are reduced or absent.
- Risk of contaminant exposure to aquatic organisms is dependent on where water-quality impairment occurs and the types of organisms (i.e., native or tolerant introduced species) that are exposed.

9:50 – 10:10 am

Cindy Robertson, Staff Biologist
Idaho Department of Fish and Game
P.O. Box 25
Boise, Idaho 83707
Phone: (208) 287-2715; Fax: (208) 334-2114
Email: crobertson@idfg.state.id.us

Link to Presentation: *Idaho's Instream Flow Program—Past, Present, and Future*

Idaho's instream flow program has its roots dating back to the 1920's. In 1925, the Legislature passed statutes that declared preservation of minimum lake levels in Idaho's largest natural lakes for scenic beauty, health, and recreation was a beneficial use of such water. The position was reaffirmed in 1971 and 1978 with the "Malad Canyon case" and the passage of an instream flow statute, respectively. The statute declares that public health, safety, and welfare require that streams be protected to preserve minimum flows for fish and wildlife habitat, aquatic life, recreation, aesthetic beauty, transportation and navigation, and water quality. Currently, 100 applications for instream flows or minimum lake levels have been filed. Approximately 672 miles are currently protected by licenses or permits and an additional 290 miles of streams are in the application stage. We have other mechanisms that provide protection for important waterways, including the comprehensive state water plan legislation created in 1988, which encourages fostering instream flows to protect and preserve aquatic life, recreation, aesthetics, and minimization of pollution. Future mechanisms for providing protection of instream flows will likely include the existing instream flow legislation, comprehensive state water plans, the Idaho Water Transactions Program, and water bank programs. Other alternatives may include water leasing, water right transfers, and conservation agreements.

10:40 – 11:00 am

Joe A. Baldwin and Michael J. Cook
Technical Services Division
Idaho Department of Environmental Quality
1410 N. Hilton
Boise, Idaho 83706

Environmental Isotope Studies of Wastewater and Ground Water at Wastewater Land Treatment Sites in Idaho

Ground water contamination, whether from land-treatment or other adjacent land uses, exists in proximity to several wastewater land-treatment sites in Idaho. Contaminant sources are often difficult to discern. This reconnaissance study utilized environmental (stable) isotope analyses (15N, 18O, 34S, and 2H) of wastewaters and ground water to determine the feasibility of utilizing such analyses to help determine contaminant sources. Ground water and wastewater were sampled at 24 land-treatment facility sites. Ground water mixing zone modeling was conducted to determine whether predicted differences in isotopic signatures of up-gradient and down-gradient ground water are great enough to discern wastewater land-treatment as a contaminant source.Results indicated that isotopic enrichment generally takes place as ground (source) water is transformed to wastewater and as wastewater is stored. Modeling predicted that, for certain facilities, sufficient difference in up- and down-gradient ground water isotopic signatures may exist to discern contaminant sources. Site-specific follow-up studies are recommended.

11:00 - 11:20 am

John Welhan [1], Melissa Merrick [2], Ken Neely [3] and Ed Hagen [3]
[1] Idaho Geological Survey; [2] Idaho State University; [3] Idaho Department of Water Resources

[1]Dr. John Welhan
Research Geologist, Idaho Geological Survey
Affiliate Faculty, Idaho State University
Department of Geosciences
Campus Box 8072
Pocatello, Idaho 83209-8072
Phone: (208) 282-3235
Fax: (208) 282-4414

The Use of 2- and 3D Kriging to Prioritize Spatial and Temporal Water Quality Trends

Kriging is an optimal spatial estimator that honors all measurements, accounts for redundancy of clustered data, and minimizes estimation variance (_k2); in its simplest form, it can be used to produce maps of the spatial variability of ground water quality on the basis of monitoring well measurements. Kriging estimates and their estimation variances, derived from two different sampling events, can be used to classify changes in water quality that are statistically significant or insignificant at a specified confidence level.

Kriging may also be used to produce maps of the probability that nitrate exceeds a specified threshold or action level (e.g., over what area is it more than 90% probable that nitrate-N exceeds 5 mg/l?). Such maps, produced from data collected at different times, can be summarized in a single map of exceedance

frequency (where is the 90% probability level chronically exceeded?).
A relatively new approach--spatial/temporal (ST) kriging--maximizes the return on monitoring information by exploiting the similarity (temporal persistence) of nitrate values measured at a locale over time (in the same or different wells) to improve estimation confidence. In effect, data collected over multiple sampling events are used to create a space-time "map" of how nitrate varies in geographic space over the life of the network. The sampling design and database behind Idaho's Statewide Ground Water Quality Monitoring Network makes it possible to exploit the advantages of ST kriging. Eleven years of Statewide data from the Treasure Valley are used to demonstrate how estimation maps can be improved (by reducing S_k^2), how confidence levels in temporal change assessment can be increased, and how chronic exceedance maps can be constructed more accurately.

Based on chronic exceedance and statistically-significant change maps, we propose a method to delineate priority nitrate management areas that is quantifiable, statistically defensible, and can be updated on a regular basis as new monitoring information accrues. The western Snake River Plain is used as an example of how such a method can be practically applied.

1:00 - 2:00 p.m.

Panel Discussion: TMDLs and Surface Water

Link to Presentation: *Water Quality Enhancement Efforts*
Jerry Nicolescu, Idaho Soil Conservation Commission
Link to Presentation: *TMDL Impacts on DEQ's Surface Water Program*
Michael McIntyre, Surface Water Programs Manager

2:00 – 2:20 pm

Jim O'Connor
U.S. Geological Survey
10615 SE Cherry Blossom Dr.
Portland, Oregon 97216
Phone: (503) 251-3222; Fax: (503) 251-3470
Email: oconnor@usgs.gov

River Channels and Valley Bottoms: Floods, Forests and Fish

River channels and valley bottoms are zones of concentrated human and ecologic activity. Consequently, river and floodplain processes have long been a focus of studies by engineers, geologists, and biologists, and interest is growing amid increasing recognition of the human and ecological consequences of watershed development and modification. Recent studies of diverse rivers in the Pacific Northwest show that channel and valley-bottom morphology (and associated habitat and hazard conditions) result from complex interactions among flow, sediment movement, and vegetated floodplains, which in turn relate to basin geologic, hydrologic, and climatic conditions. For many rivers, physical and biological processes intertwine over timescales ranging from individual flow events to millennia to produce highly varied and productive channel and floodplain habitats.

2:20 – 2:40 pm

Chris Tretter
Fish Biologist / CWE Coordinator
Idaho Department of Lands
Coeur d'Alene Staff Office
3780 Industrial Avenue So.
Coeur d'Alene, Idaho 83815
Phone: (208) 666-8628
Email: ctretter@idl.state.id.us

Idaho Department of Lands Cumulative Watershed Effects Analysis

In 1991, the Idaho Forest Practices Act was amended to include provisions to minimize the impacts of the cumulative effect of forest practices. The amendment defined cumulative watershed effects as:

…the impact on water quality or beneficial uses which result from the incremental impact of two or more forest practices. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

Idaho Code §38-1303 (17)

The Idaho Department of Lands, relying in input from large private landowners, state and federal resource managers, and environmental interest groups developed a cumulative watershed effects analysis and control process that will ensure watersheds are managed to protect water quality so that beneficial uses are supported. The process is systematic, structured, reproducible, defensible and adaptable, thereby ensuring its technical and practical integrity. It is designed to give trained evaluators an understanding of:

1. The inherent hazards of the landscape within a watershed;
2. The relationship between stream temperature and the current conditions within a watershed;
3. The relationship between hydrologic processes and the disturbance history in a watershed;
4. The current condition of erosion processes within a watershed;
5. The physical stability and current condition of the stream channel;
6. The quality of water in the stream and its ability to support beneficial uses;
7. Fish habitat connectivity;
8. The interrelationships among all the above as they might have been affected by forest practices in the watershed.

The assessment relies on direct observations in the stream and on the surrounding landscape. These observations help the evaluator develop an understanding of the slope and stream processes at work in a watershed, and the cause-and-effect relationships between disturbance in the watershed and the stream itself. The current condition of the stream can be determined, effects of future forest practices anticipated, and management practices developed to correct any adverse conditions.

3:20 – 3:40 pm

Jennifer Claire
Water Quality Analyst
Department of Environmental Quality
Twin Falls Regional Office
Phone: (208) 736-2190

Water Quality of the Little Wood River Subbasin

A total maximum daily load is in the process of being developed for the Little Wood River Subbasin. As part of this development, nonpoint source industries (irrigated agriculture, grazing, septic systems, mining) account for a major component of the pollutant sources in this subbasin. BURP and water quality field monitoring of various tributaries (5) to the Little Wood River, along with the river itself, will be discussed along with any statistical relationships that may be pertinent.

3:40 – 4:00 pm

Robert B. Tiedemann, CPWS, CWD, CFS, CWB
Ecological Design, Inc.
217 North Walnut Street
Boise, Idaho
Email: ecodesigninc@mac.com

The Effects of Climate Change on the Vegetated Floodplains of Idaho Rivers and the Quality of Water in Their Channels

A simulation model constructed by the Climate Impacts Group of the University of Washington predicts warmer and wetter winters for the Pacific Northwest and a three to six degree rise in average annual temperatures. For Idaho rivers that accumulate much of their runoff in high elevation snow pack—like the Snake, Clearwater, and upper reaches of the St. Joe and Coeur d'Alene—this will result in peak runoff occurring earlier in the spring because of the early onset of snow melt and flood flows of higher magnitude because of the greater probability for rain on snow events. For other rivers—with much of their watersheds at lower elevations and already vulnerable to periods of snow melt during the winter, such as the Weiser River—this will exacerbate an existing, perennial occurrence of winter flooding.

The social, environmental, and economic impacts of climate change depend on the physical ability of the river channel to accommodate this alteration in flow regime, downstream land use, and the requirements placed on river managers to satisfy their commitments to the public. For urban waterways, like the Boise River where reservoirs both store irrigation water and provide flood protection and where the snow pack is a non-structural "second reservoir", this will likely result in a rebalancing of priorities. For other waterways without on or off system storage, like the Payette and Salmon, this may mean we learn to accommodate the run of the river.

Higher flows resulting from climate change will likely cause instability in Idaho rivers and be expressed by lateral migration and deepening of their channels. This could result in the additional generation and transport of sediments and an increase in the size of particles that can be moved. A change in the timing of peak flows may alter the season and duration of downstream movement of the bulk of nutrients derived from decomposition of organic matter. This may make nutrients less biologically available throughout the year to primary producers and alter the communities that feed on them. Also, with climate change the timing of flood flows may be out of synch with the seed shower of black cottonwood (Populus trichocarpa) and other native plant species resulting in a possible shift toward a preponderance of herbaceous, annual, and exotic species. The resulting loss in area of canopy provided by the black cottonwood forest will allow for greater solar exposure and result in higher river water temperatures, and loss of their fibrous roots will result in the greater potential for scour of exposed banks with the further introduction of sediments to the water.

However, the greatest potential for alteration of rivers and their floodplains, and the quantity and quality of water in their channels depends on the response of the agricultural and urban communities to climate change in Idaho. For example, the desire to irrigate for greater periods of time to take advantage of a longer growing season could take form as mining the groundwater resource, to the detriment of groundwater discharge dependent rivers, or the use of more efficient irrigation practices. The need to manage the greater risk to public health and safety from floods could take form as construction of more dams and levees or the conservation of floodplains as open space to accommodate this change in flow regime. Decisions affecting our well being and the resources of our river systems will be arbitrated with knowledge of the values of Idaho communities, but must also be made with accurate science and a discuss of consequences. This paper contributes to that discussion.

4:00 – 4:20 pm

Michael Etcheverry
Senior Water Quality Analyst
Idaho Department of Environmental Quality
601 Pole Line Road, Suite 2
Twin Falls, Idaho 83301-3035
Phone: (208)-736-2190; Fax: (208)-736-2194
E-mail: metcheve@deq.state.id.us

Water Enhancement Projects for TMDL Implications in South Central Idaho

Six TMDLs have been approved in the IDEQ-TFRO region and two more have been submitted to the USEPA for approval in 2003. The original six TMDLs have Implementation Plans in various stages of implementation. IDEQ-TFRO is currently coordinating implementation with the various watershed advisory groups, the Upper Snake-Basin Advisory Group, all water users industries, sister state agencies, federal land management agencies, and the general public. Many 319 NPS projects are being used to help meet load and wasteload allocation targets on surface waters of the region. In addition many of the local interests have instituted water quality enhancement projects to meet their part of the TMDL cleanup effort. The cooperation between federal, state, and local governments, SCD districts, individuals and private entities along with providing funding for projects has encouraged the implementation process throughout the region.

4:20 - 4:40 pm

Dr. Balthasar B. Buhidar, Ph.D
Idaho Department of Environmental Quality
601 Pole Line Road, Suite 2
Twin Falls, Idaho 83301-3035
208 736-2190, FAX:736-2194
bbuhidar@deq.state.id.us

Billingsley Creek-When the Worst Case Scenario is Worse than the Worst

Billingsley Creek is a 7-mile spring fed creek that exists in the Hagerman Valley of south-central Idaho. Water quality impacts to the stream include aquaculture fish hatcheries, confined feeding operations, irrigated agriculture, and grazing. In recent years the flow of the stream has been reduced substantially due to a number of known and unknown sources. As the creek is reduced in water volume, the macrophytes and algae have been increasing. A TMDL is being written that is considering these and other aspects of the creek.

THURSDAY, January 8, 2004

8:00 – 8:20 am

Paul F. Woods
Hydrologist (Limnology)
U.S. Geological Survey
230 Collins Road
Boise, Idaho 83702
Phone: (208) 387-1353
Email: pfwoods@usgs.gov

Link to Presentation: *Role of Limnological Processes in Fate and Transport of Nitrogen and Phosphorus Loads Delivered into Coeur d'Alene Lake and Lake Pend Oreille, Idaho, and Flathead Lake, Montana*

The fate and transport of nutrient loads, following their delivery into a lake, are governed by the integration of all hydrologic, physical, chemical, and biological processes that operate within that lake. The fate and transport of nitrogen and phosphorus delivered into northern Idaho's Coeur d'Alene Lake and Lake Pend Oreille and northwestern Montana's Flathead Lake were evaluated on the basis of their retention of nutrient loads, computed from the quantitative difference between input and output loads of the two nutrients.

Lake Pend Oreille received and discharged the largest loads of nitrogen and phosphorus; Coeur d'Alene Lake received and discharged the smallest loads. Coeur d'Alene Lake and Lake Pend Oreille retained about 15 percent of the nitrogen loads they received; Flathead Lake retained about one-third of the nitrogen load it received. Compared with nitrogen retention, phosphorus retention was much different for Coeur d'Alene and Flathead Lakes; respectively, they retained about one-half and three-fourths of the phosphorus loads they received. Lake Pend Oreille retained less than 17 percent of the phosphorus load it received.

Retention of nutrient loads, or the lack thereof in the case of Lake Pend Oreille, was strongly related to circulation processes, in both spatial and temporal contexts, within the three lakes. The inflow plumes from their principal tributaries were routed in-lake primarily as overflows, especially during snowmelt runoff, when each lake received most of its annual nutrient load. In the case of Lake Pend Oreille, its inflow plume was routed primarily into its northern outlet basin by the formation of a thermal bar along the approximate boundary between its shallow (mean depth of 29 meters) northern basin and its deep (mean depth of 220 meters) southern basin.

8:20 – 8:40 am

Tim Burton
Fisheries Biologist
USDI - Bureau of Land Management
1387 South Vinnell Way
Boise, Idaho 83709-1657
Phone: (208) 373-3819
Email: Tim_Burton@blm.gov

Link to Presentation: *The Interagency Implementation Monitoring Module*

The Interagency Implementation Monitoring Program (IIT Monitoring Module) is intended to track implementation of management direction for salmon, steelhead, and bull trout in the Upper Columbia and Snake River Basins. The program has been developed jointly by the National Oceanic and Atmospheric Administration Fisheries Service (NOAA-Fisheries), the U.S. Fish And Wildlife Service (USFWS), the U.S. Environmental Protection Agency (USEPA), the USFS, and the BLM. These five agencies have a resource goal of restoring and conserving anadromous and inland native fish populations and aquatic habitat. Pending development of long-term recovery and conservation strategies, the agencies' focus has been to halt the degradation and begin the restoration of anadromous and inland native fish populations and aquatic habitat. In support of this, the agencies are working together to improve monitoring accountability, increase efficiency, ensure that the level of monitoring is commensurate with the level of on-the-ground activities, and provide feedback on the effects of activities. The Implementation Monitoring Program is part of this effort.

The Implementation Monitoring Program provides a consistent, defendable process for the USFS and BLM to collect and report results of implementation monitoring. The sample scheme ensures that all activities are monitored with appropriate frequency and distribution to provide necessary and timely information for adapting management actions to meet the management direction in the aquatic conservation plans – PACFISH and INFISH. The focus of the Implementation Monitoring Program is on assessing if projects and activities were designed and conducted per the management direction in PACFISH and INFISH; however, as such it provides needed information for determining the effectiveness of that direction, as addressed by the related Effectiveness Monitoring Program.

8:40 – 9:00 am

Christine Fischer
Idaho Association of Soil Conservation District
1551 Baldy Avenue, Suite #2
Pocatello, ID 83201
Phone: 208-237-4628, ext 110
Email: cfischer@agri.state.id.us

Water Quality Monitoring in the Upper Teton River Subbasin

The Idaho Association of Soil Conservation Districts (IASCD) began water quality monitoring in March 2002 on the tributaries to the Teton River. This monitoring project began in response to the Teton River Subbasin Total Maximum Daily Load (TMDL) that was written by the Idaho State Department of Environmental Quality. The tributaries being monitored are Badger, Spring, South Leigh, Packsaddle, Darby and Fox creeks. IASCD, in cooperation with Idaho Soil Conservation Commission, the Teton Soil Conservation District and the Madison Soil and Water Conservation District, will develop the implementation plan for agriculture. This water quality data will assist in the determining priority subwatersheds to implement best management practices. Total suspended solids exceed the 80 mg/L TMDL target during spring runoff. Total phosphorus exceeds the 0.10 mg/L TMDL target during the spring runoff. Nitrate and nitrite concentrations are three to five times higher than the 0.30 mg/L TMDL target on tributaries flowing from the east side of the valley. Friends of the Teton River (FTR), a non-profit organization, have been monitoring Fox and Darby creeks towards their headwaters. The data will be compared between the upper FTR data and the lower IASCD monitoring data. IASCD monitoring will continue through 2004 to further evaluate the nutrients in the upper Teton River subbasin.

9:00 – 9:20 am

Chris Mebane
NOAA Fisheries Liaison
U.S. Geological Survey
230 Collins Rd
Boise, ID 83702
NOAA Phone: (208) 685-6906; NOAA Fax: (208)378-5699
Email: cmebane@usgs.gov or chris.mebane@noaa.gov

Link to Presentation: *Application of Species and Life-Stage Specific Temperature Criteria in Oregon*

In April 2003, the EPA released their "EPA Region 10 guidance for Pacific Northwest state and tribal temperature water quality standards" which recommended a much more complex set of criteria than the criteria in use in PNW states. In May 2003, a federal court overruled EPA, NOAA, and USFWS's earlier approval of Oregon's temperature criteria. A key finding of the court was that since Oregon's criteria didn't explicitly state when and where they applied, they were deficient. These events placed the agencies in a challenging situation – how to apply the new EPA guidance in ~90 days, rather than the anticipated 3 years. An interagency group was duly created and directed to figure out how to match EPA's guidance with when and where different life stages of different salmonid species used habitats at different temperatures.

The primary biological and geographical information sources used by the group working to develop Oregon's draft proposed temperature criteria was the Oregon Department of Fish and Wildlife's Natural Resources Information Management Program (ODFW-NRIM), Oregon Department of Environmental Quality's technical work group recommendations on existing and potential bull trout habitat and various "decision rules." These "decision rules" were developed in order to uniformly apply EPA's temperature guidance statewide, using a transparent rationale that would enable reviewers to readily reconstruct the basis for the proposed designations. Because of court-ordered time constraints, the process relied heavily on information that was available through geographical information systems (GIS) over much of the state. The generic "decision rules" were intended to work with information that was readily available at a statewide scale, or at least at a broad scale. The decision rules attempt to reduce the complex information on species distributions and the usual timing of different life stages or activities by different species into a system of regulatory temperature criteria. These generic rules may be supplanted in some areas where more location-specific and scientifically defensible information was available.

Time periods of adult salmon and steelhead spawning and juvenile habitat use were particularly relevant under the "decision rules." Timing of habitat uses had been cataloged statewide by the ODFW NRMIP and organized into 194 geographic areas with similar time periods of life history stages and activities for the different anadromous and resident salmon and trout species (e.g. adult migration from the ocean, spawning, hatching, fry rearing, juvenile outmigration to the ocean). Key information considered in the decision rules for what summer-maximum temperature criteria to assign to a stream is related to which salmonid species are present in the reach during July and August. For example, if there were no significant rearing use in July or August by any anadromous salmonid, the reach would be assigned a 20ºC summer maximum criteria to protect it use as a migratory corridor, whereas if there were significant rearing use, it would be assigned a 18ºC summer maximum criteria. The timing of adult spawning was important in the decision rules both in determining summer maximum criteria to protect adult fish during holding and pre-spawning, and in setting the times that criteria specific to spawning and incubation would apply in the fall and spring. Information on actual temperatures, thermal modeling, critical sub-populations, or locations with high spawning densities was also supposed to be considered.

The process and results of setting the summer maximum and spawning criteria will be illustrated for Grande Ronde/Hells Canyon area in NE Oregon, including a comparison of existing temperature data and the proposed criteria.

10:00 – 10:20 am

Lynn R. Van Every [1] and Josh Romeis [2]

[1]Idaho Department of Environmental Quality
Pocatello Regional Office
444 Hospital Way #300
Pocatello, ID 83201
Phone: 208-236-6160,
Fax: 208-236-6168
lvanever@deq.state.id.us

[2]Tetra Tech EM Inc.
1325 Airmotive Way #200
Reno, Nevada 89502
Phone: 775-333-8457
Fax: 775-322-3987
josh.romeis@ttemi.com

Water Quality Impacts From Selenium and Other Metals in the Southeastern Idaho Phosphate Mining Resource Area: A Total Maximum Daily Load (TMDL) Perspective

Nearly 40 percent of the U.S. phosphate reserves occur in the Phosphoria Formation in southeastern Idaho, northern Utah and western Wyoming. Much of these reserves are located within the Southeastern Idaho Phosphate Mining Resource Area, which covers approximately 2500 square miles. For over fifty years, large-scale open pit and contour strip operations in the Resource Area have mined surface exposures of the Meade Peak Phosphatic Shale Member of the Phosphoria Formation. Low-grade ore, typically referred to as middle-waste shales, appear to contain the highest levels of selenium and other potentially toxic trace metals. These waste materials, historically disposed of in external waste rock dumps, are subject to oxidation with subsequent mobilization and transport of metals to surface waters. In 1996, isolated livestock losses associated with excessive selenium uptake prompted concerns about potential ecological and human health impacts from current and historic mining operations in the Resource Area. Since 1997, numerous data characterizing surface water quality, soils, vegetation, and fish, bird, elk and other tissue have been collected in the resource area to formulate a human health and ecological risk assessment. Perennial waters in the Resource Area are protected by the State of Idaho for coldwater aquatic life beneficial uses and national toxics criteria apply. Water quality data collected prior to 2001 demonstrated exceedances of water quality criteria for selenium and other metals, but the sampling protocol typically did not meet sampling criteria sufficient to determine water quality violations. In 2001, the Idaho Department of Environmental Quality undertook a three-year investigation to document water quality impacts to perennial streams from phosphate mining in the Blackfoot River, Salt River, and Bear River watersheds. The objectives of the investigation were to establish a baseline for surface water quality in the watersheds, determine if numeric water quality criteria for coldwater aquatic life have been exceeded, and if water quality violations have occurred. To that end, surface water quality monitoring was performed at 31 surface water stations in 2001, 10 stations in 2002, and 13 stations in 2003. Results of the investigation suggest that the highest selenium concentrations and loads occur during the spring runoff following snowmelt. In particular streams, observed selenium concentrations have exceeded chronic and acute toxics criteria for coldwater aquatic life. Results of the investigation pertinent to the State of Idaho Total Maximum Daily Load program will be presented including a discussion of climatic conditions and other factors relevant to selenium in Resource Area streams.

10:20 – 10:40 am

Eric Stiles, TSC D-8570
Bureau of Reclamation
P.O. Box 25007
Denver, CO 80225-0007
Phone: (303) 445-2458
E-mail: estiles@do.usbr.gov

Created Wetlands and Stream Checks as BMP Components for Small Tributaries in the Cascade Reservoir Watershed

From 1995 to 2000, several small created wetlands and riparian restoration projects were established on minor tributaries in the vicinity of Cascade Reservoir in western Idaho. These projects were undertaken to enhance the limited wetlands habitat in the area. These projects also provided an opportunity to evaluate the water quality characteristics and potential role as BMP components in the ongoing watershed planning in the Cascade Basin. Six of the test sites were monitored during the summer months from 1996 to 2000 to collect data on flow rates, nutrients, suspended solids, enteric bacteria, and other chemical parameters. Statistical data analyses were completed to examine changes in concentrations and mass loads as water passes through the sites and possible correlations with seasonal shifts, loading conditions, or interactions with particulate matter. Water quality results are generally characterized by variability that is attributed to the monthly sampling and flow measurements. Incremental decrease in dissolved and ortho-phosphorus and increases in chlorophyll, ammonia, and organic nitrogen were evident at two of the sites. Significant removal of enteric bacteria occurred at the four sites in the lower valley. All six sites were undersized for optimal phosphorus removal, however, this was recognized during project planning and site plans were developed to adapt features within prevalent site conditions and available resources. As a result, the test sites represent a practical approach for applying tributary BMP's. Factors that could affect site selection and strategies applied are described in the full project report, currently in production. Site features were established rapidly and have provided additional wetlands habitat, productivity, recreation, and education benefits. Overall, these small wetland and riparian restoration projects can contribute to improved water quality by reducing erosion, attenuating hydrologic fluctuations, establishing vegetative filter buffers, and assimilating certain types of waterborne materials. Actual water quality characteristics depend on the specific constituents of concern and conditions established at the site. Phosphorus is complicated by the multiple adsorption, sedimentation, precipitation, biomass uptake and cycling, and long-term sequestering processes that can influence the effective transport and removal characteristics. Implications of tributary wetlands on the timing of seasonal uptake and release cycles, hydrologic factors, and interactions with reservoir operations are important topics that require more detailed investigation.

10:40 – 11:00 am

Charlie Luce (Presenter)
USDA Forest Service
Rocky Mountain Research Station
316 E. Myrtle St.
Boise, ID 83702
Phone: (208) 373-4382; Fax: (208) 373-4391
Email: cluce@fs.fed.us

Bruce Rieman
Phone: (208) 373-4382; Fax: (208) 373-4391
Email: brieman@fs.fed.us

Jason Dunham
Phone: (208) 373-4382; Fax: (208) 373-4391
Email: jbdunham@fs.fed.us

Jack King
Phone: (208) 373-4382; Fax: (208) 373-4391
Email: jgking@fs.fed.us

Link to Presentation: *Large-Scale Patterns in Geomorphic Disturbance and the Ecology of Stream Fishes in the Boise River Basin*

Current paradigms in management and regulation of forestlands relative to geomorphic processes and aquatic ecosystems focus on the mass of material generated per unit time, often at the scale of small watersheds. Increasing understanding of the dynamics of stream habitats and of the ecology of fishes in mountain basins suggests that a paradigm recognizing patch dynamics and the spatial and temporal distribution of conditions across watersheds may have greater utility in conservation of sensitive species. Metapopulation theory considers the interactions of local populations associated with habitat patches, whose extent can be defined by environmental controls such as passage barriers or thermal conditions in streams. Within patches, occupancy may be highly variable in time, but the probability of a global extinction across a metapopulation is much lower, except in the case of all local populations fluctuating in perfect synchrony. The size of habitat patches in relation to the size and continuity of disturbances will define the relative vulnerability of individual populations. Asynchrony and dispersal among patches can facilitate gene flow, demographic support, and even recolonization following catastrophic disturbance, important to the stability and persistence of the regional or "meta" population. The application of metapopulation concepts in concert with a temporally and spatially explicit evaluation of severe geomorphic disturbance to channels may help explain the large-scale patterns of occurrence or persistence in some stream dwelling species. Comparison of bull trout population and genetic structure with sequential mapping of severe channel disturbance over the last 40 years across the entire Boise River basin reveals a concordance among the scales of disturbance, patch size effects, and patterns of gene flow. Recent observations of the recovery of populations following severe disturbances related to fire provide information about the relevant time scales for population responses. Our results support a metapopulation paradigm for sensitive species conservation with important implications for habitat fragmentation, the relative risk of wildfire versus the management intended to reduce its severity and spread, and the role geomorphic processes across entire river basins.

11:00 – 11:20 am

Don A. Essig
Idaho Department of Environmental Quality
1410 N. Hilton
Boise, Idaho 83706
Email: dessig@deq.state.id.us

Link to Presentation: *The Interplay Between Water Quality Criteria and Monitoring*

A primary purpose of water quality criteria is to define when water quality becomes harmful to aquatic life. Such definition is complicated by the nature of individual water quality constituents. While some pollutants are manmade chemicals, others are natural, even necessary, constituents of aquatic ecosystems. Some natural constituents, such as temperature and dissolved oxygen, are fundamental to ecological function and become pollution only if adversely altered by human activity. The concept of alteration implies a measure of change, not an absolute threshold of harm. Indeed, natural harm plays an important ecological role in species distributions. Other natural pollutants, such as trace metals, may be less fundamental to ecological function, but still can occur naturally in harmful amounts. Concentrations of natural constituents are often quite variable, making determination of natural conditions, or change from them, difficult.

Water quality standards for toxics employ acute and chronic criteria. These criteria are based on duration of exposure that few monitoring data can describe. Thus adverse exposure may occur without detection, depending on the variation in water quality for the toxin in question. More frequent monitoring is likely needed to truly evaluate these criteria. Water temperature presents the opposite case. The rapid increase in continuous monitoring of temperature provides far more data than needed to evaluate current criteria, and reveals a need for more sophisticated criteria that account for duration of exposure. Dissolved oxygen presents a case in which detailed monitoring is becoming more common, and may call into question criteria that were based on older, less complete knowledge of natural variability.

To date, setting of water quality criteria has focused primarily on biological needs, and has largely ignored natural variability and monitoring capabilities. This has led to criteria lower than we can detect, expressions of criteria that require more monitoring than we can afford, and criteria that guard against less data than we have. To avoid missed problems and false alarms, we need to better match the expression of criteria with the capabilities of monitoring as well as what we know of natural variability.

11:20 – 11:40 am

Rick Carlson
Ground Water Program Manager
Idaho Department of Agriculture
2270 Old Penitentiary Road
Boise, Idaho 83712
Phone: (208) 332-8599
Email: RCARLSON@agri.state.id.us

Link to Presentation: *Results of Stable Isotope Testing to Determine Ground Water Nitrate Sources—The ISDA Agricultural Ground Water Quality Protection Program*

The Idaho State Department of Agriculture (ISDA) implements agricultural ground water quality monitoring to characterize degradation of ground water quality by contaminants leaching from agricultural sources. As part of these monitoring efforts, ISDA is using stable isotope testing to better evaluate sources of ground water nitrate found within many aquifers in agricultural areas across Idaho. Testing has focused on nitrogen and oxygen isotopes for this evaluation.

Results over three years of stable isotope testing have produced mixed results. However, isotope test findings have proven useful as a strong indicator of nitrate pollutant sources for some local-scale projects related to dairies and confined feeding operations. Nitrogen isotope testing in 2002 of regional-scale project wells with nitrate levels of greater than 5 milligrams per liter indicate potential source percentages in Idaho of 26 percent fertilizer, 65 percent mixed source or organic, and 9 percent human or animal waste.

POSTERS

Ken Neely and Ed Hagan
Idaho Department of Water Resources
John Welhan
Idaho Geological Survey

Thirteen Years of Nitrate and Pesticide Data Results from the Statewide Program

The Statewide Ground Water Quality Monitoring Program went into full-scale operation in 1991. By the end of the 2003 field season, over 1900 monitoring sites (mostly wells and a few springs) had been sampled throughout Idaho. Each year, about 400 sites are sampled based on a rotation plan where most sites are now being sampled once every five years, and about 100 sites are sampled every year. The development of the Statewide Network has resulted in three Rounds of data collection so far: Round 1—sites sampled in 1991–1994, Round 2—sites sampled in 1995–1998, and Round 3—sites sampled in 1999–2003.

Nitrate and pesticide sample results are summarized as follows:

1. 96 of the 1868 sites (5 percent) had at least one sample with nitrate over the MCL of 10 milligrams per Liter (mg/L); another 202 sites (11 percent) had nitrate in the 5 to 10 mg/L range.
2. Based on the maximum nitrate value at each site, the median was 1.3 mg/L, the mean was 2.9 mg/L, and the range was from less than the reporting limit of 0.05 mg/L to 110 mg/L.
3. Of the 1196 sites sampled in both the First and Third Rounds, 158 sites (13 percent) had nitrate increases greater than 1 mg/L, and 87 sites (7 percent) had nitrate decreases greater than 1 mg/L.
4. The places with the greatest nitrate impacts were the Treasure Valley, Weiser area, and Twin Falls County.
5. 21 of the 100 Annual sites (21 percent) had trends that were significant at the 95 percent confidence level. Of the Annual sites with nitrate values over 1 mg/L, 8 had significant increases, and 5 had significant decreases at the 95 percent confidence level.
6. Pesticides are detected more frequently at sites with elevated levels of nitrate. Samples containing a nitrate concentration above 10 mg/L were twice as likely to contain a pesticide as samples not containing nitrate.

Ann Storrar and Dustan Bott
Nez Perce Tribe Water Resources Division
P.O. Box 365
Lapwai, Idaho 83843
Phone: (208) 883-1428
Emails: anns@nezperce.org — dustanb@nezperce.org

Nez Perce Tribe TMDL Implementation "Getting it Done"

The Nez Perce Tribe Reservation is located in north-central Idaho along the mainstem of the Clearwater River. The Reservation area, comprised of 770,480 acres, has shared ownership among Tribal, private, state, and federal entities. Approximately 12% is Tribally owned and managed. Many jurisdictional issues result from the diverse land ownership within the Reservation boundary.

Reservation watersheds are heavily impacted by agriculture, with 378,870 acres (49%) in cropland. Logging in forested headwaters and grazing also impact watersheds. Winter wheat, small grains, canola/rape seed, and bluegrass are the main crops on cultivated land. The Reservation also contains concentrated animal feeding operations and winter feeding areas. Currently 22 stream segments are 303(d) listed with TMDLs due in 2006. Primary pollutants include sediment, temperature, nutrients, and bacteria.

The Nez Perce Tribe has collaborated in MOAs with the State of Idaho and EPA for development of the 4 currently completed TMDLs containing Reservation waterbodies (Winchester Watershed and Upper Lapwai Creek 1999, Cottonwood Creek Watershed 2000, Jim Ford Watershed 2000, and the South Fork of the Clearwater River 2003). This collaboration has continued through the implementation phase and enables a holistic approach for watershed restoration on the Reservation.

A variety of grant sources (federal, state, and private) have been utilized to work with agencies and private landowners toward achieving TMDL water quality goals. The projects listed below have been funded and implemented by the Tribe, primarily on Tribal land, although one corridor was planted by the Tribe for a group of non-Tribal private landowners to assist in meeting TMDL water quality targets.

Winchester Watershed projects include: riparian corridor plantings; road stabilization (new culverts, gates, rolling dips, gravel application); campground improvements (riparian planting, road improvements, and fire rings); off-site watering and hardened crossings, Mud Springs Reservoir outlet and shoreline stabilization. Projects in the Cottonwood Watershed include: grants to farmers for no-till farming, corridor fencing, hardening cattle crossings, riparian corridor plantings, and road recontouring. The Tribe looks forward to beginning implementation in the South Fork Clearwater Watershed.

Mir M. Seyedbagheri, Professor
University of Idaho/Elmore County Extension
535 E. Jackson
Mountain Home, ID 83647
Phone: (208) 587-2136, ext. 509; Fax: (208) 587-2137
Email: elmore@uidaho.edu

Practical Considerations of Soils, Plant and Organic Matter, and Hydrology for BMP's for Crop Production and Sediment Control

Important sources of nonpoint water pollution include nutrients, pesticides, and sediment. Reducing the load of these contaminants in ground and surface water can be managed by using several practical and well-researched applied practices.

For the past six years, University of Idaho Elmore County Extension conducted studies of nitrogen mineralization and watermark sensors and Hansen meters in irrigated crop production. Understanding of soil moisture levels, nitrogen mineralization, the timing of nitrogen release, and its utilization in the total nitrogen pool has a pronounced role in the development of best management practices for minimizing nitrate in our water resources.

Understanding the soil food web (biological communities in the soil) and its role in crop production, reclamation, and restoration has been showing very promising outcomes in enhancing soil quality for crop production and re vegetation in highly disturbed soils. Understanding the physical and chemical characteristics of the soils, knowing and using the topsoil and the right soil amendments, and evaluating the characteristics that make a plant suitable for stabilizing soil surfaces have shown very consistent and promising results in sediment control.

Overall, the viewpoint from many experts in this field highlights the missing links in soil, plant, and water relationships. Overcoming these barriers will positively impact the success of BMP’s in crop production and other sediment control practices.

Ken Skinner
U.S. Geological Survey
230 Collins Road
Boise, Idaho 83702
Phone: (208) 387-1343; Fax: (208) 387-1372
Email: kskinner@usgs.gov

Boise River Water Quality and Biodiversity

The poster displays a LANDSAT image of the lower Boise River Valley overlain with locations of USGS water-quality and biological sampling sites. This poster represents an interactive digital map of the area, which consists of a large collection of detailed geospatial data sets (including LANDSAT imagery, aerial photos, shaded relief, and topographic maps). Included in the interactive map are several slide shows, linked to specific map locations, that describe various aspects of water quality and biodiversity in the Boise River, from relatively pristine sites upstream from Boise to downstream sites that are impacted by urban and agricultural runoff. One of the slide shows, from the City of Boise, features locations of two sewage-treatment plants along the Boise River, and another slide show, from the U.S. Fish and Wildlife Service, features some of the wildlife at Lake Lowell and Dear Flat National Wildlife Refuge.

Alan Rea and Jacque Coles
U.S. Geological Survey
230 Collins Road
Boise, Idaho 83702
Phone: Al (208) 387-1323; Jacque (208) 387- 1390; Fax: (208) 387-1372
Email: ahrea@usgs.gov - jdcoles@usgs.gov

StreamStats: A Web Application for Streamflow Statistics and Basin Characteristics

StreamStats is a partnership between USGS and ESRI to develop an online application that links USGS digital map data, streamflow statistics, and regression equations with ESRI's ArcHydro tools. The application delineates the basin above a user-selected point on a stream, calculates the basin characteristics (such as area and slope), and uses those characteristics with USGS regression equations to calculate probable streamflow.

Why should you care? Every time there is a new bridge, culvert, construction in a stream, or channel modification, an engineer calculates the probable floods in that stream. Before digital maps, the calculation process was tedious and subject to errors. Calculations for even a modestly sized basin could take hours. The process now can be done in a few minutes. The State highway departments and Federal land managers (such as the U.S. Forest Service) require these calculations to determine whether the designs for structures such as highways, culverts, and bridges are adequate. Because of the safety risks involved in floods, these agencies are very specific about the flood calculation process and have funded the USGS for decades to regularly update the regression equations. Automating the process eventually will save the taxpayer millions of dollars and improve the final products. There are many other potential applications, such as estimating flows for water-quality management or endangered fish habitat.